CAPE HATTERAS NATIONAL SEASHORE
2007 ANNUAL PIPING PLOVER (*CHARADRIUS MELODUS*) REPORT

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Introduction

Piping plover (PIPL) monitoring at Cape Hatteras National Seashore (CAHA) began in 1985. Monitoring focuses on identifying nesting habitat, locating breeding plovers and nests, protecting territories and nests, and determining nest and brood success. This report contains a summary of monitoring results for 2007 (Appendix A), comparisons to results from previous years and management activities for 2007.

Methods

Pre-nesting Closures

Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, and Ocracoke Inlet Spit (South Point) all contain potential nesting habitat. Nesting has occurred in all of these areas in the last 10 years (Appendix B, Maps 1-4). Pre-nesting closures were posted at all these locations by April 1st. The pre-nesting closures included the upper beach, dunes, sand/mud flats, and sound side shoreline at Ocracoke and Bodie Island Spits. The pre-nesting closures were modified throughout the season to provide adequate protection for nesting birds and broods (Appendix B, Maps 1-4). A full-beach closure on the west side of the Cape Point to Ramp 45 was added on April 5th and a closure was installed at the north end of Ocracoke April 8th for protection of plover foraging sites.

Monitoring

Resource management staff began monitoring for PIPL arrival and pre-nesting behavior in late March and early April. Monitoring and surveys of these sites was conducted a minimum of three times per week. Once a nest was located, nests were briefly approached once a week to inspect the exclosure, count eggs and search for predator tracks. Morning and evening observations began when nests were expected to hatch. Monitors would observe from a distance for evidence of hatching, or chicks. All known nests were protected by predator exclosures. Exclosures have been used at CAHA since 1994. Exclosures are circular in shape (~10 feet in diameter), made of 2 inch by 4 inch welded-wire fence anchored with steel rebar and topped with ¾ inch mesh bird netting. Because of problems with predation, one exclosure was installed before clutch completion and/or initiation of incubation.

After hatching, the broods were monitored from dawn to dusk until the chicks fledged or were lost. Monitoring was subject to occasional brief interruptions from unplanned demands on the monitor. Observers documented in their notes brood status, behavior, individual bird and/or brood movements, human disturbance, predator interactions, or other significant environmental events.

Migrating and Wintering Piping Plovers

Pilot implementation of the Southeast Coast Inventory and Monitoring Network (SECN) Migratory, Wintering, and Beached Shorebird Monitoring Protocol Study began in mid-July 2006 and continued through May 2007 at CAHA when the Student Conservation Association (SCA) intern completed her one year internship. During this time period monitoring occurred five days per week except for holidays or when the monitor took annual or sick leave. Implementation of this protocol was very time intensive. The primary objective of the study was to determine areas of consistent use by target species, including PIPL, American Oystercatcher (AMOY), and Wilson's Plover (WIPL). The pilot protocol was designed to systematically collect information pertaining to target species (i.e. PIPL, WIPL, red knot, and AMOY) in beach

areas at CAHA and provide up-to-date information to park managers to aid in management decisions. After the departure of the SCA intern, resource management staff conducted weekly surveys at the high intensity sites (i.e. points and spits) once the PIPL breeding season had ended. Shannan Stoll, a new SCA intern, took over implementation of the modified wintering protocol in October. During a conference call with David Rabon, US Fish and Wildlife Service, (USFWS) and Mike Byrne, SECN, on October 2nd, the park agreed to adopt the dates used in the International Shorebird Surveys which are conducted on or near the 5th, 15th, and 25th of each month. Monitoring efforts were to be focused on the points and spits and not the entire shoreline. Semi-permanent transect locations were established. Transects were walked (not driven) and are approximately one mile long. Each survey transect is completed within 30 minutes and all target species are documented. During the surveys the observer documents whether the plover is inside or outside a resource closure (i.e. protected vs. not protected area) or in an ORV-free zone (i.e. open to pedestrians but closed to ORVs).

Results and Discussion

Productivity

Six breeding pairs of PIPL were found at CAHA during the 2007 breeding season (Table 1; Appendix A, Maps 5-7). This represents three more pairs than were found in 2005 and the most known pairs since 1999, and equals that of 2006. In 1996, six different breeding areas supported nesting. In 2007, nesting occurred at three of the sites, Cape Point, Ocracoke Inlet and Bodie Island Spits.

Table 1. Number of PIPL Breeding Pairs by Site at CAHA (1987-2007).

Year	Total Pairs	Bodie Island Spit	Cape Point	South Beach	Hatteras Island Spit	Ocracoke (North)	Ocracoke Inlet Spit
1987	10	0	4	0	4	1	1
1989	15						
1990	14	0	8	0	4	2	0
1991	13	0	5	0	3	5	0
1992	12	0	4	0	4	4	0
1993	12	0	5	1	3	3	0
1994	11	0	5	1	3	2	0
1995	14	0	6	1	4	2	1
1996	14	1	5	1	5	1	1
1997	11	1	4	1	3	0	2
1998	9	0	4	1	3	0	1
1999	6	0	3	1	1	0	1
2000	4	0	2	0	2	0	0
2001	3	1	1	0	1	0	0
2002	2	1	0	0	1	0	0
2003	2	0	0	0	1	0	1
2004	3	1	0	0	1	0	1
2005	3	0	0	1	1	0	1
2006	6	1	2	1	1	0	1
2007	6	1	4	0	0	0	1

The six PIPL pairs produced 11 known nests this season (Table 2). Six nests successfully hatched. Four were located at Cape Point, one at Ocracoke Inlet and one at Bodie Island Spit. Average clutch size of the successful nests was 3.5 eggs, with two 4-egg and two 3-egg nests laid at Cape Point, and a 4-egg nest at Ocracoke Inlet Spit, and a 3-egg nest at Bodie Island Spit. Nine eggs hatched at Cape Point, four eggs hatched at Ocracoke and 3 eggs hatched at Bodie Island (57%). (Table 3, 3a). Four chicks fledged and the fledging rate was 0.67 chicks/breeding pair (Table 4). Since 1989 productivity rates have ranged from 0.0 to 2.0 chicks/pair. The average rate over the past 15 years is 0.66 chicks/pair (Table 4a). Although a rate of 1.2 fledged chicks/breeding pair annually would be needed to sustain the population (USFWS 1996), CAHA had the highest productivity in the state of North Carolina (pers. comm., S. Cameron). A summary of 2007 PIPL breeding pair observations provides details of seasonal resource management staff field observations of breeding pairs and nests at the three sites where breeding pairs and broods were observed (Appendix A).

Table 2. 2007 PIPL Nesting Season at CAHA.

LOCATION	# Breeding Pairs	# Nests	# Nests Hatched	# Nests Lost	# Chicks Fledged	# Chicks Lost
Bodie Island Spit	1	1	1	0	1	2
Cape Point	4	9	4	5	3	7
South Beach	0	0	0	0	0	0
Hatteras Inlet Spit	0	0	0	0	0	0
Ocracoke (North)	0	0	0	0	0	0
Ocracoke Inlet Spit	1	1	1	0	0	4
TOTAL	6	11	6	5	4	13

Table 3. PIPL Hatching Success at CAHA in 2007.

LOCATION	# NESTS	# EGGS	NESTS LOST/ ABANDONED		NESTS HATCHED		EGGS HATCHED		NESTS W/ FLEDGED CHICKS	
			#	%	#	%	#	%	#	%
Bodie Island Spit	1	3	0	0%	1	100%	3	100%	1	100%
Cape Point	9	22	5	56%	4	44%	10	45%	3	33%
South Beach	0	0	0	0%	0	0%	0	0%	0	0%
Hatteras Inlet Spit	0	0	0	0%	0	0%	0	0%	0	0%
Ocracoke (North)	0	0	0	0%	0	0%	0	0%	0	0%
Ocracoke Inlet Spit	1	4	0	0%	1	100%	4	100%	0	0%
TOTAL	11	29	5	45%	6	55%	17	59%	4	36%

Table 3a. PIPL Hatching Success at CAHA from 1992-2007.

YEAR	# NESTS	# EGGS	NESTS LOST/ ABANDONED		NESTS HATCHED		EGGS HATCHED		NESTS W/ FLEDGED CHICKS	
			#	%	#	%	#	% (a)	#	%
2007	11	29	5	45%	6	55%	17	59%	4	36%
2006	4	15	1	25%	3	75%	9	60%	1	25%
2005	2	8	0	0%	2	100%	8	100%	2	100%
2004	2	6	1	50%	1	50%	4	66%	0	0%
2003	2	5(b)	0	0%	2	100%	4(b)	100%	1	50%
2002	3	8	2	67%	1	33%	1	13%	0	0%
2001	3	10	2	67%	1	33%	3	30%	1	33%
2000	6	23	3	50%	3	50%	10	44%	2	33%
1999	6	23	3	50%	3	50%	11	48%	3	50%
1998	8	31	2	25%	6	75%	20	65%	5	63%
1997	16	47(b)	6	38%	10	63%	32	68%	2	13%
1996	16	56(b)	6	38%	10	63%	30	53%	2	13%
1995	19	63	6	32%	13	68%	30	48%	6	32%
1994	18	65(c)	8	44%	10	56%	32(d)	49%	6	33%
1993	21	69	12	57%	9	43%	27	39%	5	24%
1992	14	49(e)	6	43%	8	57%	17	35%	6	43%

(a) - of all known eggs

(b) - assumes 1 egg from a brood whose nest was not found (see 2003 report)

(c) - assumes 2 eggs from a brood whose nest was not found (see 1992 report)

(d) - includes those presumed hatched (see 1994 report)

(e) - assumes 3 eggs from a brood whose nest was not found (see 1992 report)

Table 4. Fledging Success of PIPLs at CAHA in 2007.

Location	# Pairs	# Broods	# Chicks	Ave Brood Size (chicks/ brood)	Chicks Fledged		Broods w/Fledged Chicks		Fledge Rate (chicks/ pair)
					#	%	#	%	
Bodie Island Spit	1	1	3	3.0	1	33%	1	100%	1.00
Cape Point	4	4	10	2.5	3	30%	3	75%	0.75
South Beach	0	0	0	0.0	0	0%	0	0%	0.00
Hatteras Inlet Spit	1	0	0	0.0	0	0%	0	0%	0.00
Ocracoke (North)	0	0	0	0.0	0	0%	0	0%	0.00
Ocracoke Inlet Spit	1	1	4	4.0	0	0%	0	0%	0.00
Total	6	6	17	2.8	4	24%	4	67%	0.67

Table 4a. Fledging Success of PIPL at CAHA from 1992-2007.

Location	# Pairs	# Broods	# Chicks	Ave Brood Size (chicks/ brood)	Chicks Fledged		Broods w/Fledged Chicks		Fledge Rate (chicks/ pair)
					#	%	#	%	
2007	6	6	17	2.8	4	23%	4	67%	0.67
2006	6	3	9	3.0	3	33%	1	33%	0.50
2005	3	2	8	4.0	6	75%	2	100%	2.00
2004	3	1	4	4.0	0	0%	0	0%	0.00
2003	2	2	5(c)	2.5	1	20%	1	50%	0.50
2002	2	1	1	1.0	0	0%	0	0%	0.00
2001	3	1	3	3.0	2	67%	1	100%	0.67
2000	4	3	10	3.3	3	30%	2	67%	0.75
1999	6	3	11	3.7	7	64%	3	100%	1.20
1998	9	6	20	3.3	12	60%	5	83%	1.33
1997	11	10	32	3.3	3	9%	2	20%	0.27
1996	14	10	30	3.0	3	10%	2	20%	0.21
1995	14	13	30	2.3	7	23%	6	46%	0.50
1994	11	10(a)	32(b)	3.2	9	30%	6	60%	0.82
1993	12	9	27	3.0	8	30%	5	56%	0.67
1992	12	8	17	2.1	8	47%	6	75%	0.67

(a) - includes 2 broods whose nest was presumed hatched (see 1994 report).

(b) - includes 8 chicks from 2 nests that was presumed hatched (see 1994 report).

(c) - includes1 known chick from nest not found (see 2003 report)

Nest Loss/Abandonment

Five nests were either lost to weather, predation or were abandoned during the 2007 breeding season. Nest 1, a two-egg nest discovered May 3rd on Cape Point was lost during a Nor'easter storm on May 7th. It is unknown if the eggs were blown out of the nest scrape in the 50-60 mph winds, buried under the sand, or taken by a predator. The loss was discovered during a survey for plover nests on May 8th. A single-egg nest was discovered the same day, more than eight feet away from the first nest, and based on the timing is believed to be a third egg from the pair and was designated as Nest 2. Based on timing and location, this egg was not believed to be a single egg which rolled out of the Nest 1 scrape. The lone egg in Nest 2 was discovered missing the next day, May 9th. Nest 3 was discovered May 10th in a shell bed behind the dunes at Cape Point. Because of evident predator signs in the area and the recent loss of an incomplete nest to predation, a predator exclosure was erected that day. The exclosure was accepted by an adult within 30 minutes of the exclosures installation. Both birds were observed on or around the nest, either separately or together up until May 13th. The nest was determined to be abandoned on May 14th. The nest was designated as belonging to Pair 2, but it is possible, based on timing and territory, that it was a fourth egg from Pair 1. Nest 6 was discovered May 26th in the territory of Pair 1. It was an incomplete clutch of two eggs and was in close proximity to many least tern scrapes. The nest was monitored from a distance for several days, and while birds were seen in the area, none were seen approaching or on the nest. By June 4th it was determined that the nest had been abandoned. Nest 8 was discovered June 7th, with one egg, in the western end of the Cape Point closure in a shell bed behind the dunes. On June 10th,

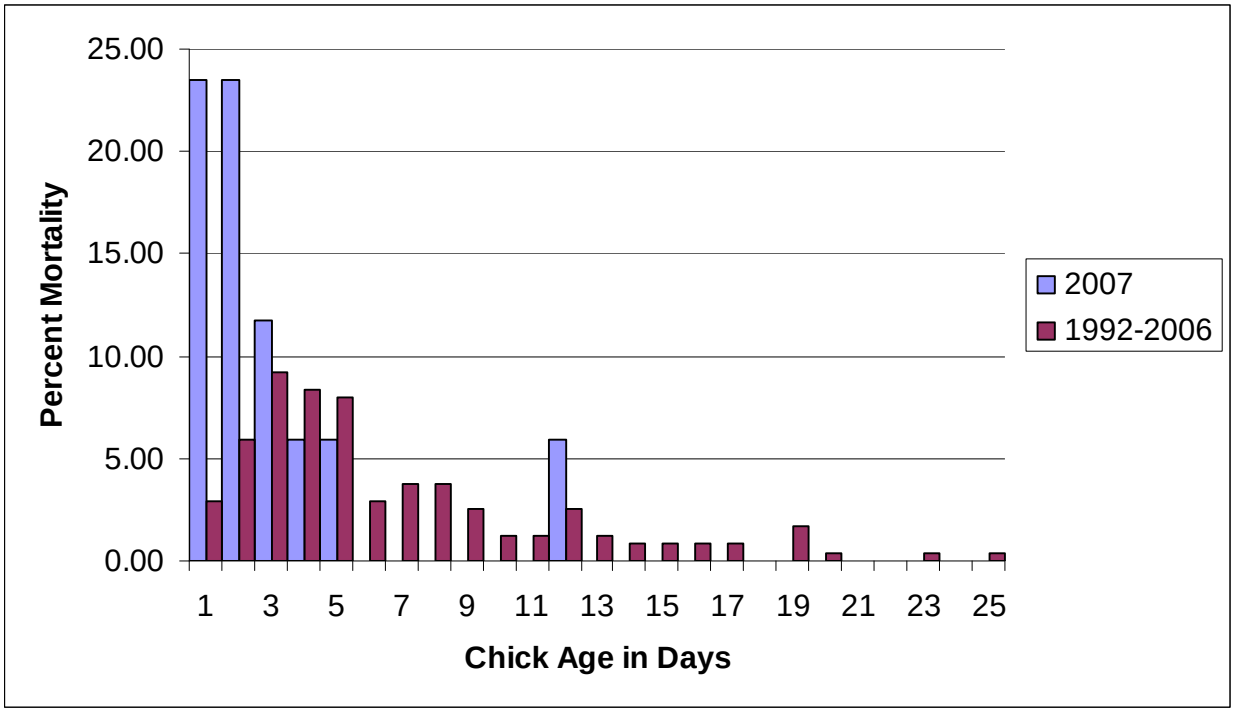
during a regular scheduled survey, two eggs were seen in the nest scrape, but on June 12th the eggs were gone and there were both raccoon and opossum tracks in the area of the nest scrape.

Chick Mortality

Of the 17 chicks that hatched, 13 were lost prior to fledging. The first brood, from Nest 4 at Cape Point, lost three of four hatchlings. Two were predated by day 3, and one by day 13. The second brood, from Nest 5 at Cape Point, lost both of the two hatchlings by days 2 and 5. The third brood, Nest 7 on Ocracoke, lost all four of the hatchlings; two by day 1, and then one on day 4 and the last remaining chick had disappeared by day 5.

Although the staff has opinions with varying levels of confidence on what may have caused mortality in different situations, mortality cause is characterized as unknown unless specific evidence can support a cause. Potential causes are discussed in following sections of this report even though the mortality is characterized as "unknown". As in past years, the majority of chick mortality occurred within ten days of hatching (Figure 1).

Figure 1. Age Distribution of PIPL Chick Mortality at CAHA (1992-2007).



Chick Movement

As a result of dawn to dusk monitoring, staff was able to document preferred foraging areas for the different broods. The brood from Nest 4 after foraging to the east of the nest site around the ephemeral ponds for the first week until the ponds dried up, established itself on the west side of the small Salt Pond (Appendix B, Map 8). They stayed in a 500 foot area between the small Salt Pond

and the nest area throughout the chick rearing period. The brood and adults foraged all along the western shoreline of the small pond and on the flats on the northwestern side of the pond.

The brood from Nest 5 moved ~900 feet from the nest exclosure and into Brood 4's foraging territory (Appendix B, Map 8). The adult pairs immediately began territorial disputes. The adults from Brood 5 and a single chick disappeared after the second day of "fighting". The remaining chick from Brood 5 was observed being brooded and attended to by the adult male from Brood 4, but being pecked at and chased off by the female. That chick disappeared after day 3.

The four chicks from Brood 7 on Ocracoke, moved approximately 2,000 feet from the nest exclosure behind the dunes on the ocean side, and followed the dunes in a westerly direction toward the sound, where they foraged along the sound-side mudflats, until all the chicks were lost (Appendix B, Map 9).

After Brood 9 hatched, the adults and the surviving chick moved more than 1,600 feet east from the nest exclosure to the east side of the small Salt Pond (Appendix B, Map 9). The chick and adults were consistently found in that area until the chick fledged.

After hatching, Brood 10 spent most of the time foraging just in front and to the south of the nest exclosure until two chicks were lost to predation on day 2. By day 6, the remaining chick and adult were traveling almost 50 meters twice daily between the mud flats and ephemeral pond south of the nest to the southwestern corner of the Bait Pond (Appendix B, Map 10).

The day after hatching, the two chicks from Brood 11 were led by the adults north through the vegetation to the southwest end of the Salt Pond. Only one chick exited the vegetation at the large Salt Pond. The chick remained in a 300 foot area along the southwest side of the Salt Pond shoreline until it fledged (Appendix B, Map 8).

Predator Exclosures

During incubation the primary management tool used to reduce impacts from predators on nesting plovers was through the use of predator exclosures. In 2007, predator exclosures were used to protect six nests. All six predator exclosures were installed and accepted by pairs within 30 minutes.

Staff attempted to install an exclosure on one nest prior to clutch completion because of heavy predator traffic in the area and the recent loss of a PIPL nest to predation in the immediate vicinity. Staff consulted with Anne Hecht and David Rabon of the USFWS prior to deviating from the accepted practice of only installing exclosures after the clutch has been completed or the pair is observed incubating. Although both individuals from the pair appeared to readily accept the exclosure and were viewed sitting on the egg and exchanging places (entered the exclosure within 30 minutes of installation). The single egg nest was eventually abandoned four days later. Although staff actions may have contributed to the abandonment of this nest, staff felt the chances of losing this nest to predation were so high that it was worth the risk of losing this nest.

Predation

One egg was lost to a ghost crab in an exclosed nest. Nest 5, which was a full four-egg clutch when the exclosure was installed, lost an egg during late incubation. Sticks and debris were packed into the ghost crab holes inside and around the exclosure to prevent predation of more eggs. The nest hatched two of the three remaining eggs, two days later. There was also an observation of a ghost crab grabbing a PIPL chick on Ocracoke. The chick survived (at least one more day) due to the efforts of an adult PIPL to distract/attack the ghost crab.

Although staff has no direct documentation of chick loss due to predation, staff strongly believe that some of the chicks lost to "unknown" causes may be attributed to predators. The presence or tracks of crows, grackles, gulls, ghost crabs, opossum, mink, raccoon, red fox, grey fox, and feral cats, were documented within many of the PIPL breeding territories. Mammalian predation was suspected in the loss of Nests 2 and 8 based on the presence of raccoon and opossum tracks in close proximity to the nest scrapes.

Predator Removal

With the increased predator trapping effort in 2007, staff hopes to see a correlation between predator removal and increased productivity in nesting shorebirds in 2008. If fox had not been specifically targeted for removal from Bodie Island, it is unlikely that the nesting pair could have fledged their chick. For the sixth consecutive year, USDA-Wildlife Services trappers removed fox, feral cats and raccoons from CAHA. In 2007, Wildlife Services was contracted for two 10-day management sessions. Predator damage management was completed during March 8th - 17th on Bodie and Hatteras Islands and May 14th - 23rd on Bodie and Ocracoke Islands. Since trapping was initiated in 2002, 70 red fox, 30 grey fox, 133 raccoon, 46 opossum, 26 feral cats, and one feral dog have been removed by Wildlife Services. In addition to the animals removed by Wildlife Services, resource management staff removed 38 feral cats, six red fox, three grey fox, 101 raccoons, 57 opossum, 23 nutria, one muskrat, one river otter, and one mink from in and near bird nesting habitat on Bodie, Hatteras and Ocracoke Islands.

Table 5. Predators Removed from CAHA in 2007.

Agency	Red Fox	Gray Fox	Raccoon	Opossum	Feral Cat	Nutria	Muskrat	Otter	Mink
Resource Management/ Volunteer	6	3	101	57	38	23	1	1	1
USDA	12	3	34	28	19	54	0	1	0
2007 Totals	18	6	135	85	57	77	1	2	1

Human Disturbance

Human disturbance, direct or indirect, can lead to the failure of PIPL breeding success. During the period of April 1-August 31 resource staff recorded 249 pedestrian, 25 ORV, 17 dog, and 1 horse violations of bird closures. The numbers are conservative since sites are not monitored continuously, weather erases tracks, and staff did not disturb an incubating pair or young just to document disturbance. Most illegal entries were not witnessed but documented based on vehicle, pedestrian, or dog tracks left behind. Pedestrian entry required visitors to lift and stoop

under the string that connected all posted signs. Vehicular entry required visitors to drive through or around a sign boundary. Visitors' unleashed dogs are a threat to protected species and continue to be a problem. Of the 17 dog entries into closures, many dog tracks were not accompied by human footprints, indicating that the dogs were unleashed in the closures. Some of the specific observations related to human disturbance are provided in the breeding pair summary information contained in Appendix A.

Winter Closures

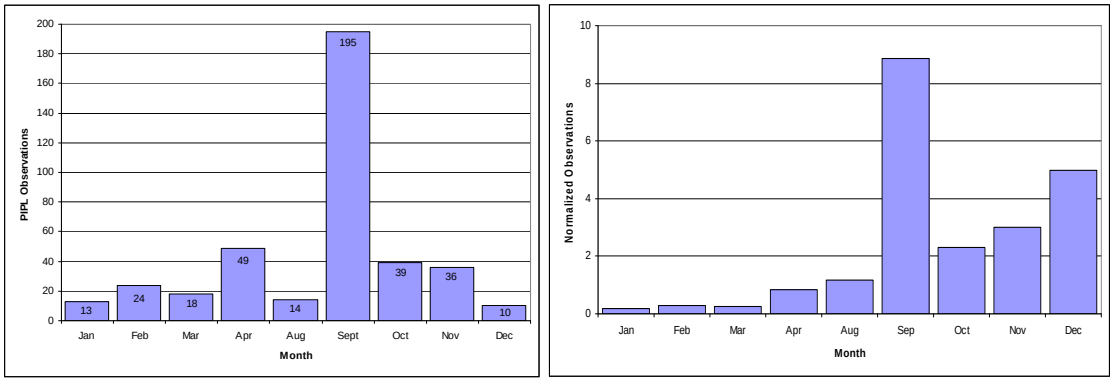
Winter closures were established upon removal of the nesting closures during the first week of September (Appendix B, Map 11). Winter closures were established to provide an undisturbed area for the migratory and over-wintering population PIPLs. In the fall and spring large numbers of PIPLs migrate through the area. The winter closures are installed in preferred foraging and stopover areas.

Non-breeding Surveys & SECN Winter Monitoring

CAHA continues to consult with the USFWS regarding changes to the winter monitoring protocol. Because of the continuing consultation and changes to the protocol during the 2007 monitoring season, the methodology used to survey and document wintering PIPL changed several times during the season making analysis of this data difficult.

Park staff documented migratory PIPL use of the seashore beginning at the end of the PIPL breeding season and began regularly scheduled observations in August. Migratory birds appeared to peak in August and September with a high count of 104 birds at Ocracoke Inlet Spit on Sept. 28 (Figure 2). Ocracoke Inlet Spit revealed the highest counts during fall migration. Both Cape Point (no PIPL observed) and Hatteras Inlet (three PIPL observed) had little to no documented wintering activity during surveys. Bodie Island Spit also had a high of three observations in October with little to no observations in the other months. There was a consistent presence of PIPLs on north Ocracoke, September through December, with a high of seven observations in October. South Ocracoke had the highest activity for the entire park with more than 175 observations in September in the three surveys.

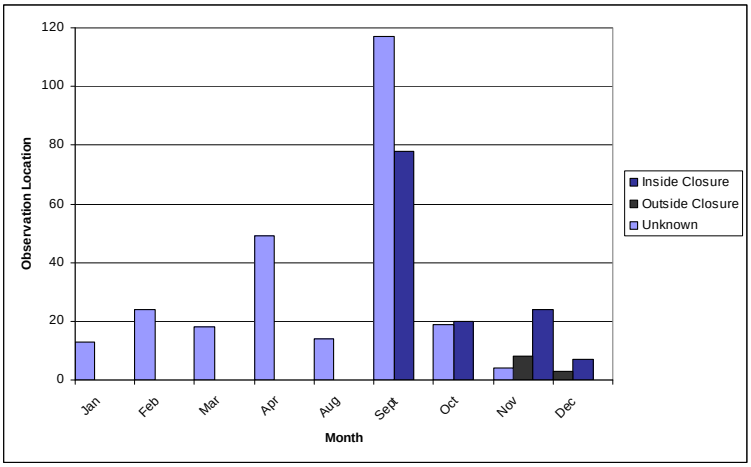
Figure 2. Actual Observation Numbers vs. Normalized Data.



The database has recently been modified so that staff can plot the number of observations that occurred inside and outside a resource closure or inside an ORV-free zone. Due to differing monitoring efforts in 2007, documentation was not made in all surveys of whether or not the

foraging/roosting PIPL was inside, or outside the winter closures, hence some observations are recorded as "unknown." (Figure 3). The database used in the pilot study emphasized habitat types and didn't document PIPL locations in reference to closures. It has now been revised to better suit CAHA management needs and data compiled in 2008 should be much easier to analyze.

Figure 3. PIPL Observations Inside and Outside of Resource Closures.



Banded Piping Plovers

Individual banded birds from the Great Lakes population and the Atlantic-Canada population were sighted at Ocracoke Inlet spit in 2007 (Table 6).

Table 6. Ocracoke Inlet Spit Banded PIPL Sightings.

Date	Left Leg-Top	Left Leg-Bottom	Rt. Leg-Top	Rt. Leg-Bottom	Location
5/16/2007	Orange	Nothing	Black	Nothing	Bodie Island Spit
8/2/2007		White		Metal/White	Ocracoke spit
11/7/2007	Unknown	Yellow	Unknown	Yellow	Bodie Island Spit

US Fish and Wildlife Service Biological Opinion

USFWS provided CAHA with a biological opinion on August 14, 2006 and an amended biological opinion on April 24, 2007. The amended biological opinion included performance measures and a new "Reinitiation Notice". Six breeding pairs of PIPLs were found at CAHA surpassing the minimum target of four breeding pairs per year. Six breeding pairs produced 11 known nests surpassing the target of 4.5 nests per year (75% of the six breeding pairs). The eleven nests resulted in four chicks fledged, which is below the target of producing on average one fledged chick per nest per year. CAHA reinitiated consultation with the USFWS via letter on December 10, 2007.